

# Indoor Air Quality in Schools

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Tuesday 21<sup>st</sup> March 2023 13:00-13:45

Thursday 23<sup>rd</sup> March 2023 14:00-14:45

# Introduction to webinar

- Why good indoor air quality is so important in education settings
- Information on the types of ventilation, and what steps can be taken to improve the indoor air quality within a setting
- Recognising the challenges brought about by cold weather and the need to reduce energy costs
- Dale Barton HANDS -feedback and expertise on the issue on the ground and associated health and safety considerations, including application of, and use of CO2 monitors
- Alastair Taylor from NY NET
- An opportunity to ask questions following the session and to provide feedback

# Background

- Most people spend 90% of their time indoors
- Poor indoor air quality is linked to disease transmission, reduced cognitive function, and other health impacts.
  - Respiratory viruses are transmitted through three main routes—contact, droplet and airborne. In poorly ventilated or crowded indoor settings aerosols can remain suspended in air or travel further than conversational distances. The evidence that good ventilation is crucial to limiting disease transmission steadily mounted during the pandemic.
  - Poor ventilation can lead to high levels of CO<sub>2</sub> in the air - increasing CO<sub>2</sub> concentration in the blood reduces the amount of oxygen available resulting in less oxygen being received by the brain, reducing cognitive function. This is referred to as the Bohr effect.
  - There is mounting evidence of the wider health effects of poor air quality (internal and external) .Short term can lead to respiratory conditions, and longer-term impacts can be cardiovascular disease, stroke, lung cancer and probably dementia.
  - We do know that children are particularly at risk from respiratory problems, such as wheezing and asthma, eye and skin complaints and reduced cognitive performance.
- But – there are measures we can take to improve this.

# Video 1

- This video gives an overview of why schools have received CO2 monitors. The monitors shown in this video may not be the monitors provided, but they do show some of the best and most versatile monitors available which may be of interest to some schools.
- <https://youtu.be/SJz0McS1kOo>

# Real example – Reigate Grammar, applying Harvard 2016 study

- Reigate Grammar found that when the windows in classrooms were shut CO2 concentrations rocketed to over 2,000 ppm.
- The Head Teacher said he would *“never close the window” in his classroom again after he tested CO2 levels during a double lesson and found that after one-and-a-half hours it had reached 2,300 parts per million (ppm).*
- Acknowledged that this is particularly relevant in exam type scenarios, when a great many children all in one room, doing something which is meant to be cognitively taxing.
  - Another example could be whole school assemblies etc. reducing concentration when key messages are being shared
- This impact will have a detrimental effect on pupil performance - if the windows and doors are closed, the pupils may not be performing as well as they could. They might be fatigued or cognitively impaired
- However - if CO2 concentrations are properly managed below 1,000 ppm performance could be improved.

# Video 2


- This video gives a practical guide to CO2 monitors use and a basis for understanding CO2 levels in practice.
- <https://youtu.be/4Oh-RSIM6ik>

# Why CO2?

- Used as a proxy measure...
- Identifying high CO2 levels can help identify areas where ventilation needs improving
- An easy indicator that is widely used – it makes the quality of the indoor air in a space 'visible'
- What CO2 levels are we looking at?
  - Building Bulletin 101 (*Guidelines on ventilation, thermal comfort and indoor air quality in schools*) provides guideline CO2 levels
    - *Regulation and statutory guidance states; Sufficient outdoor air should be supplied to general classrooms to maintain the average occupied CO2 level*

# CO2 levels

- Levels of 1000ppm and 1500ppm are defined in BB101 however evidence says that we should be aiming for 800ppm and below (Harvard study)
- Acknowledging that any improvement in indoor air is beneficial we are recommending schools aim for 1000ppm and below initially (better) and then move towards aiming for 800ppm and below (best) - with outside air on average 400ppm

	CO <sub>2</sub> level	Description	Actions	Outcomes 
Needs improvement	> 1500 ppm.	Indicative of inadequate ventilation.	Keep checking ventilation provision (e.g. windows and doors are open) and the CO <sub>2</sub> levels. If consistent, notify school leadership.	There are quite high levels of shared/rebreathed air in your classroom which, if maintained, might lead to poorer learning and health outcomes.
Better	800 ppm to 1500 ppm.	Potential for stuffy/stale air and lethargic learners.	Open windows and/or doors – higher-level openings first and then lower-level openings.	Potential to improve ventilation in your classroom should be considered for better health and learning outcomes.
Best	< 800 ppm.	Indicative of good ventilation.	If CO <sub>2</sub> levels are not rising, and if the classroom is cold then you can consider slightly closing your window opening extents. Do so slowly and steadily.	Ventilation should be acting to help reduce the risk of airborne transmission but only as part of a fuller range of mitigation measures ( <a href="https://www.gov.uk/government/collections/guidance-for-schools-coronavirus-covid-19">https://www.gov.uk/government/collections/guidance-for-schools-coronavirus-covid-19</a> ).
	Close to, or just above, 400 ppm.	Typical outdoor reading.	No actions required, but if your classroom is cold then the windows can be slightly closed.	Your classroom might be overventilated – this might not be of direct concern, but if your classroom is cold then you might be wasting energy and affect the learning experience.



# Video 3

- This video covers the considerations for virus transmission and CO2 – note COVID-19 is a focus due to the time of production of the video but the principles can be translated into many other areas, such as transmission of other respiratory illnesses such as colds and flu
- <https://youtu.be/1QnrQDyIPGs>

# Video 4

- This final video covers the key implications for air quality on effective learning and concentration.
- <https://youtu.be/MI-TMoRyQK4>

# Our guidance on Indoor Air Quality

## 1. Start by measuring the air

- Through a CO2 monitor, think about placement of monitors and any existing barriers you have to using them
- Or, passive through *smell/feel* i.e. *does the room smell bad or feel stuffy?*

## 2. Improve the air

### A. By reducing the source of air pollution

- ✓ Consider areas where pollutants are produced in significant quantities
  - Pollutants here are referring to other things released into the air, not just CO2, however CO2 remains a good proxy indicator
  - Can they be extracted before they spread through the rest of the building? Examples could be kitchen and bathroom areas, or design and technology / art / science areas etc.
  - This could also be areas of the school that are exposed to external pollutants, i.e. classrooms adjacent to busy roads etc.
- ✓ Consider any occasional activities, which might generate extra pollutants
  - For example, fumes from paint and other types of maintenance, external works etc.

### B. By improving ventilation

- Trickle Ventilation
  - Trickle vents on windows, small window opening, keeping doors ajar
- Purge Ventilation
  - Opening windows and/or doors fully for a short period of time i.e. brief but sudden changeover of air

# What if the air quality doesn't improve or fall below limits?

Following the steps outlined earlier you may need to consider using alternative filtration options to improve the indoor air, such as an air cleaning unit (HEPA filter).

- We appreciate that there are cost and resource implications to this
- Important to note that an air cleaning unit will help reduce contaminants but it's not a long-term solution, as they won't improve the issue of poor ventilation. If ventilation is consistently poor, you still need a plan to improve ventilation.
  - Seek expert advice if required, and consider information available in BB101 guidance to address the underlying issue

# Indoor air quality and saving energy

- It is acknowledged that there can be a tension between good ventilation and maintaining a comfortable (and healthy) temperature – recognised as a challenge for the engineering and construction industry for the future.
- However there are things you can try to help navigate this.
  - ✓ Opening high up windows can help reduce cold draughts. If any windows are painted shut, get them unstuck.
  - ✓ Ensure existing ventilation such as vents fans, ducts, air bricks etc. are maintained, cleaned and unblocked.
  - ✓ Bear in mind that when it's cold and windy it is easier to ventilate as you can get away with smaller openings or opening occasionally (bigger temperature differences between indoors and outdoors creates more airflow).
  - ✓ Use a CO2 monitor to let you know when to open a window, and just as importantly in cold weather – when you can close it again.

# Outdoor Pollutant Ingress

- We acknowledge this is an issue – outdoor air is indoor air where we let it in.
- Use a pragmatic common sense approach, i.e. don't open windows over a busy road etc.
- If you can't get enough clean outside air inside then if you can, seek to explore using a HEPA filter or explore alternative indoor ventilation options.
- BB101 provides advice on intake of air into buildings, principles could be applied to windows/doors etc. Seek expert advice as needed.

# Summary

- Good indoor air quality:
  - Reduces the risk of disease transmission
  - Improves cognitive function and learning ability
  - Reduces health risks (long and short term) from other harmful indoor air pollutants
- Take whatever steps you can to improve ventilation where needed – anything you do to improve ventilation will help.
- Make a start > better approach > best approach

# Feedback and Expertise on the ground

- Findings from Premises Inspections
- Follow the manufacturer's instructions to understand how to use your portable monitor correctly.
- Place monitors at head height when seated and away from windows, doors, or air supply openings.
- Position them at least 50cm away from people as their exhaled breath contains Co<sub>2</sub>, any closer could give misleading measurements.



# Feedback and Expertise on the ground

- Ensure fresh air sources are not impeded by curtains, blinds etc. especially if readings start to rise, try to leave them uncovered to allow for airflow.
- Don't plug the USB directly into a computer that is then used by an operator as they will be breathing directly into the monitor giving a false reading.
- The Co2 reading takes a while to settle, so if you are checking monitors please ensure that it is left in place for at least 1 hour after switching it on before attempting to take a measurement to ensure a reliable reading.

# Feedback and Expertise on the ground

- If you're getting odd readings or high values when you think you shouldn't the monitor may need recalibration. Take it outside to a sheltered spot, use the battery power, and leave on for about 15-30 minutes. If it is reading between 400 and 500ppm then it's ok.

# Next Steps

- Any steps you can take to improve indoor air quality (even small ones) are going to help.
- Feedback
  - Email us at [dph@northyorks.gov.uk](mailto:dph@northyorks.gov.uk)
- Challenges using the government supplied CO2 monitors – what would make it easier/better?
  - How can we help?
  - What are the challenges you have faced?
  - Are you actively doing this already?
  - *If not, why not?*
  - Do you feel able to *give this a go* now?
- Any schools willing to share with us how they manage ventilation etc.
- Guidance dissemination with implementation support
  - Additional resources and further reading within guidance

# Any questions or comments?

Email us at [dph@northyorks.gov.uk](mailto:dph@northyorks.gov.uk)

# Air Quality Monitoring

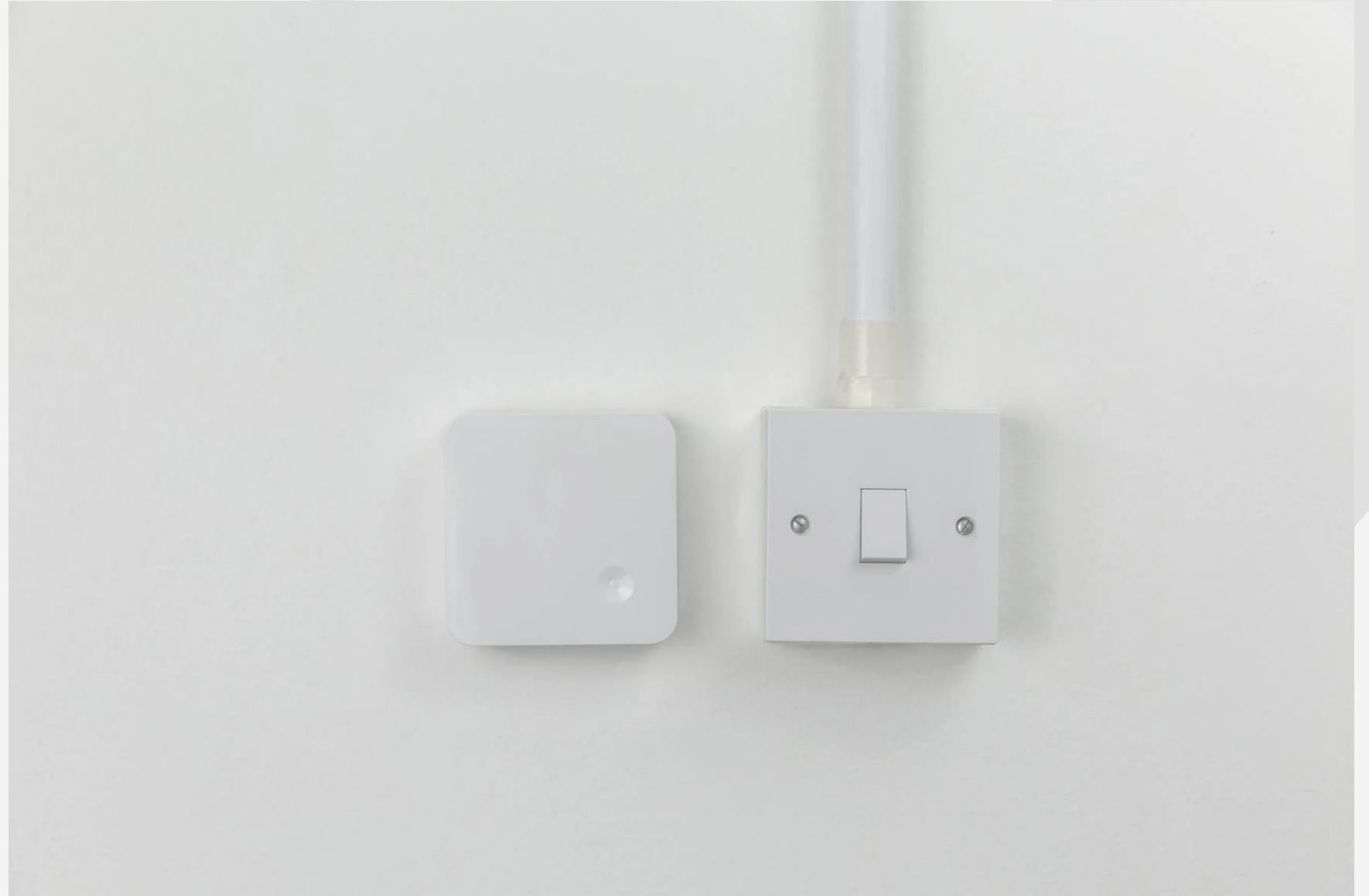
Alastair Taylor



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## Devices





# Platform

Overview Locations Sensors Users

## Overview

### School

Classroom	Reading (ppm)	Status	Updated
Classroom 1A	751	Green	7 minutes ago
Classroom 2B	738	Green	7 minutes ago
Classroom 3C	1136	Orange	7 minutes ago
Classroom 4D	741	Green	7 minutes ago
Classroom 5E	725	Green	7 minutes ago
Classroom 6F	2278	Red	7 minutes ago
Classroom 7G	726	Green	7 minutes ago
Classroom 8H	728	Green	7 minutes ago
Classroom 7G	711	Green	7 minutes ago

### Primary School

No sensors assigned to this location...

### Academy



## Alerts

### Alerts:

- When the air quality is poor
- Every 5 minutes for 25 minutes whilst poor
- When the air quality is good again and windows can be shut





# Questions or Volunteers?

[alastair.taylor@nynet.co.uk](mailto:alastair.taylor@nynet.co.uk)

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Thank you

